Department of Commerce • National Oceanic & Atmospheric Administration • National Weather Service

***NATIONAL WEATHER SERVICE INSTRUCTION 10-1305***
**March 2, 2006**

***Operations and Services***
***Surface Observing Program (Land), NDSPD 10-13***

***Observational Quality Control - General***

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**NOTICE:** This publication is available at: http://www.nws.noaa.gov/directives/

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**OPR:** W/OS7 (J. Heil) **Certified by:** W/OS7 (M. Campbell)
**Type of Issuance:** Routine.

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***SUMMARY OF REVISIONS:*** This directive supersedes NWSI 10-1305, "Observational Quality Control - General," dated September 30, 2002; and ASOS Operational Procedure NWS93-010M, "ASOS Notice to Airmen (NOTAM) Reporting," dated July 1, 1996, filed with WSOH #7, Surface Weather Observations and Reports. Changes are: (1) Observing Program Leader (OPL) is included with references to the Data Acquisition Program Manager (DAPM); (2) observer training material is only provided to NWS personnel; (3) added Appendix on quality control of Automated Surface Observing Systems (ASOS).

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Signed February 16, 2006

Dennis McCarthy Date
Director, Office of Climate,
Water, and Weather Services

# Observational Quality Control - General

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1. Purpose. This instruction defines the role and responsibility of the National Weather Service (NWS) in performing the Quality Control (QC) of manual and automated observations.

2. General. Weather and hydrologic analyses and forecasts are dependent on the quality of observational data. The accuracy of climatological records is also dependent on the quality of observations. The observations must conform to standards to ensure high quality data. These demands can be met in part by a thorough and effective QC program. Local observational data collected at the Weather Forecast Office (WFO) and River Forecast Center (RFC) are subjected to manual and automated QC routines. These data include, but are not limited to reports from the Automated Surface Observing System (ASOS), manual METAR observing stations, manual land

synoptic stations, cooperative observing stations, local mesonet data providers, hydrological observation stations, marine reporting stations, upper air stations, and radar stations. These stations and systems employ a variety of sensor technologies, siting criteria, and observing practices. This diversity introduces variability in the quality, accuracy, timeliness, and precision of the data being measured and reported. When these differences are excessive, they should be reconciled, and as appropriate, corrected in a timely fashion to the extent allowed by local resources.

The QC of manual and automated observations consists of two activities: preventive and corrective.

a. Preventive activities include setting observing standards, observer training, observer certification, station inspections, internal QC of manual stations, and internal QC of automated systems.

b. Corrective QC is accomplished through a three-tier system:

(1) real-time QC prior to transmission of the observation;

(2) near real-time QC monitoring and review activities within 1-2 hours after the observation is transmitted;

(3) national, regional, and local post real-time QC on observations performed centrally two or more hours after data transmission.

3. Responsibility and Organization. The following paragraphs outline the QC responsibilities of Weather Service Headquarters, National Centers for Environmental Prediction (NCEP), Regional Headquarters Offices, WFOs, and RFCs.

3.1 National Weather Service Headquarters. The Office of Climate, Water, and Weather Services (OCWWS) provides national policy, procedures, and standards for QC of manual and automated observations. OCWWS coordinates QC of observations with other NWS offices and federal, state, and local agencies. OCWWS develops and distributes observer training materials for the NWS and coordinates administration of observer certification examinations. Within OCCWS, the Hydrologic Services Division evaluates requirements for hydrometeorological data QC received from the Hydrologic Services Divisions at Regional Headquarters and field offices. The Office of Hydrological Development supports QC procedures used in hydrologic operations at WFOs and RFCs.

3.2 National Centers for Environmental Prediction. The NCEP Central Operations (NCO) and other NCEP Centers in the Washington, DC, area maintain a near constant QC operation under the supervision of the Data Management and Quality Assessment Branch supervisor. The NCEP Senior Duty Meteorologist (SDM) is responsible for guaranteeing that accurate data reports are received in near real time and in sufficient quantity for use in analyses and numerical

forecast models. The NCEP SDM is responsible for making the final decision on the quality of individual types of upper air data, including satellite and aircraft data, and generally supervises the QC performed by other centers on various types of surface land and sea data. Quality controlled data are additionally archived for model development and are also sent to the National Climatic Data Center (NCDC) for climatological and historical archiving. The monitoring and reviewing of observational data are accomplished by:

a. NCO upper air data decoders which check and correct data for format errors for both NCEP analyses and models, and for Advanced Weather Interactive Processing System (AWIPS) use.

b. automated QC programs which weigh, correct and delete data.

c. manual QC which can intervene and make the final decision on the quality of data by modifying or deleting the data or by countermanding automated QC decisions.

d. weekly and monthly reports on individual upper air data sites concerning the quantity, quality and timeliness of data reported, and also on the flight performance of the radiosondes, which are sent to the OCWWS and the Regional Headquarters for their use in the management and assessment of their observational QC programs.

3.3 Regional Headquarters Offices. The regional headquarters are responsible for administering the observational QC program within their region in accordance with policies, procedures, standards established by OCWWS, and for unique Regional responsibilities. The regional headquarters' activities include conducting periodic inspection visits; resolving regional QC issues; administering the observer certification program; and serving as contracting officer technical representative for NWS weather observing contracts.

3.4 Weather Forecast Office (WFO). The Meteorologist In Charge (MIC) is responsible for execution of the QC program for observations within the designated County Warning Area (CWA) and Hydrologic Service Area (HSA) of the WFO. The authority to carry out this responsibility may be delegated to the Data Acquisition Program Manager (DAPM), Observing Program Leader (OPL), or other personnel designated by the MIC. Duties associated with the QC program include, but are not limited to:

a. monitoring and reviewing observations.

b. taking corrective action as appropriate.

c. station inspection visitations. (See NWSI 10-1303, Inspection Procedure Guideline - Surface Observation Sites)

d. observer training as local resources permit. (Other agencies, e.g., the Federal Aviation Administration (FAA) are responsible for their own training activities.)

e. administering observer certification examinations. (See NWSI 10-1304, Certification of Observers)

3.5 River Forecast Center. When appropriate, the RFCs should participate in the coordination of NWS observational network-related issues, including the design, development, and maintenance of these networks. RFCs rely on hydrometeorological data from networks operated by the NWS and other agencies such as the U.S. Geological Survey, U.S. Army Corps of Engineers, and local cooperators. Data from these networks are simultaneously received at RFCs and WFOs through real-time distribution mechanisms. While WFOs have responsibility for QC of data from both the NWS cooperative network and other hydrometeorological networks, RFCs also perform QC of data used in their hydrologic modeling and forecast operations.

4. Overall Quality Control Program. The quality of observational data is maintained through observer training and certification, station visitation and inspection, observation monitoring and review, program oversight and coordination. With expanding volumes of data available at NWS offices from automated sensor networks, sophisticated automated QC routines are increasingly essential for ensuring the integrity of the data provided to the user community.

4.1 Observer Training and Certification. Observer training programs must ensure minimum proficiency standards for providing complete, accurate, and timely observations. The NWS, FAA, and Department of Defense (DOD) conduct Federal observer training programs for their respective agency, that may include formal classroom, computer based instruction, or on-site training. The NWS is responsible for all civilian weather observer certification. Supplementary Aviation Weather Reporting Station personnel training should be obtained through the private sector.

4.2 Station Visitations. The responsibility for administering the station and Inspection program for areas in a CWA is shared between the regional headquarters and the MIC of the CWA. The responsibility for administering the station visitation and Inspection program for areas outside of a CWA rests with the regional headquarters. Detailed information on the station visitation program is contained in NWSI 10-1303 and regional supplements to the NWS Directives System (NDS). QC personnel performing station visitations and inspections will be knowledgeable of the program they are reviewing.

4.3 Observation Monitoring and Review. The MIC will ensure WFO personnel assigned QC activities monitor and review observational data from all stations within the CWA and HSA.

a. Monitoring includes examining observations and noting problems. Monitoring also includes taking corrective actions (near real time).

b. Review includes checking weather records to ensure completeness, correctness, and consistency of transmitted reports. Review also involves responding in a timely and effective manner to QC reports and summary statistics (post real time).

4.4 Program Oversight and Coordination.

4.4.1 National Weather Service Headquarters. The OCWWS, through NDS, provides national guidance, direction, and oversight for QC of manual and automated observations. The OCWWS coordinates with headquarters of other agencies on various QC issues such as observing policy, procedures, monitoring and review, training, and user education.

4.4.2 National Centers for Environmental Prediction. NCEP has a World Meteorological Organization (WMO) obligation to produce standard monthly reports concerning the quantity and quality of many types of data as well as producing standard measures of NCEP model forecast skill. In addition, NCEP produces additional reports on data problems as necessary. Besides these reports, NCEP receives similar reports from other international meteorological centers. As a result of this exchange of information with other centers, problem sites can be placed on a reject list, if needed, until the problem is corrected. Meanwhile, problem sites are contacted, missing data problems are resolved and modelers can be notified of significant changes in forecast skill.

4.4.3 Regional Headquarters Offices. The regional headquarters implement OCWWS policy and provide regional guidance, direction, and oversight to the field office. They issue and maintain NDS supplements on various QC issues and assist the field in interpreting and clarifying national guidance and directives.

4.4.4 Weather Forecast Office. The WFO provides oversight for meteorological and hydrologic QC operations, ensures observations are representative of surrounding locations, and coordinates with other federal, state, and local agencies and private sector entities to resolve QC problems in their CWA.

4.4.5 River Forecast Center. The RFC provides oversight for meteorological and hydrologic QC operations for input into hydrologic models and coordinates with the WFOs to resolve problems.

5. Forms and Reports - General. Station inspection forms and reports, observer certification examination summaries (for applicable programs), and periodic QC reports and assessments are essential to gauge the health of the observing program. They provide a statistical foundation to assess performance, isolate deficiencies and identify remedies. Station inspection forms and other reports should be objective, factual, and complete. Specific details for what must be contained in these forms and other reports are described in NDS and regional supplements.

# APPENDIX A - Quality Control of ASOS Observations

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1. General. Each WFO should have an on-station QC reference source (e.g., binder) with information about each ASOS for which it has QC responsibility. The references may include information on levels of service, phone numbers for points of contact, and other documentation such as user guides, observing handbooks, operations manuals, and description of automated quality control programs, site initialization data, and method of external communication.

1.1 Level of Service. A list of scheduled hours of operation for the on-site observing staff should be maintained for each ASOS in the WFOs designated CWA of responsibility. During these hours the site shall be considered an "attended" ASOS; at all other times it should be considered an "unattended" ASOS.

The FAA, NWS, and aviation industry established four levels of detail in weather observations at sites where there is a commissioned ASOS. The service level at each ASOS may be adjusted based on the actual hours of operation. For example, a site designated service level "C" may revert to service level "D" during hours when the facility is closed. A current list of assigned service levels can be found at: http://www.avmet.com/awad/AWADReport.cfm.

1.2 Points of Contact. A list of phone numbers for points of contact should be maintained at the WFO. This phone list may include:

a. Automated Flight Service Station (AFSS)
b. Air Traffic Control Tower (ATCT) at the ASOS site
c. Limited Aviation Weather Reporting Station (LAWRS)

d. Supplementary Aviation Weather Reporting Station (SAWRS, SAWRS-II, and BSAWRS)
e. Contract Weather Observation (CWO)
f. Non-Federal Observer (NF-OBS)
g. NWS Regional ASOS focal point
h. NWS Regional Contract focal point
I. ASOS Operations and Monitoring Center (AOMC) hotline
j. ASOS voice and data line numbers
k. FAA Operations Control Center phone numbers:
AOCC: 877-434-1182
MOCC: 866-432-2622 or 913-254-8175
POCC: 800-269-6665

1.3 ASOS Documentation. The following documents are available for use at the WFO:

a. ASOS User's Guide
b. ASOS Ready Reference Guide
c. ASOS Software User's Manual
d. Federal Meteorological Handbook No. 1, Surface Weather Observations and Reports http://www.ofcm.gov/fmh-1/fmh1.htm
e. FAA Order 7900.5 http://www.faa.gov/ATpubs/SWO/SWO.pdf
f. FAA Order 7210.3 http://www.faa.gov/ATpubs/FAC/INDEX.htm

If these documents are not available, requests for them should be through the Regional Headquarters.

1.4 Automated Programs for ASOS QC. To increase effectiveness and reduce workload involved in the monitoring and coordination aspects of ASOS QC, automated programs are available for use at the WFO via AWIPS. WFOs should consider how these automated programs may be used at the local level.

2. Specific Procedures. The WFO staff should, time permitting, routinely check the observations from each ASOS in the CWA. The following procedures are minimum guidelines for QC actions, which should be taken consistent with established priorities, when a problem with the ASOS report is detected. Problems are defined as being either missing reports, missing elements, erroneous data, or improperly formatted data. The WFO staff as directed by the MIC may take additional action. These procedures are broken down by unattended locations and attended locations.

2.1 Unattended Locations - Missing Reports. When hourly METAR reports are missing from long-line transmission for two hours or more, AOMC will investigate and initiate an appropriate maintenance action. No QC action is required by the WFO. If a SAWRS observer requests permission to provide backup observations, exercise discretion in deciding to grant permission. Do not permit dual observations of elements from the same location at the same time.

2.2 Unattended Locations - Missing Elements. Missing elements will normally be noted and an appropriate maintenance action will be initiated by AOMC. However, under certain circumstances, additional missing elements from an ASOS may be temporarily masked from detection by AOMC. In this case, the WFO may inform AOMC of the additional missing element(s).

2.3 Unattended Locations - Erroneous Data. If data are considered marginally or temporarily unrepresentative and the sensor otherwise appears to be operating normally, no action is required by the WFO. However, if data are clearly erroneous due to sensor or equipment failure and the problem appears on two or more consecutive METAR reports, then inform the AOMC and request that "Report Processing" for the erroneous sensor(s) be turned off.

2.4 Attended Locations - Missing Reports. AOMC routinely monitors ASOS locations for missing reports and will initiate appropriate maintenance action when necessary. However, if it appears that expected backup observations are not provided after two or more consecutive METAR reports, corrective action should be taken. The appropriate FAA shift supervisor (ATCT, AFSS, etc.) should be notified and if applicable the on-site observer. Normally, the ATCT shift supervisor will make any additional notification to FAA and CWO observing personnel. For chronic unresolved problems, the DAPM/OPL will coordinate actions with the NWS regional Observations Program Manager. This may include a site visit, contact with the associated FAA Regional Air Traffic Division Operations Manager or designee.

If a SAWRS observer requests permission to provide backup observations, exercise discretion in deciding to grant permission. Do not permit dual observations from the same location at the same time.

2.5 Attended Locations - Missing Elements, Erroneous Data, and Improperly Formatted Data. Notify the appropriate FAA shift supervisor (ATCT, AFSS, etc.) if ASOS element(s) are missing, if ASOS data are suspected of being erroneous, or if data are improperly formatted for two or more consecutive METAR reports. Normally, the ATCT shift supervisor will make any additional notification to FAA and CWO observing personnel. For chronic unresolved problems, the DAPM/OPL will coordinate actions with the NWS regional Observations Program Manager. This may include a site visit, contact with the associated FAA Regional Air Traffic Division Operations Manager or designee.

If SAWRS backup observations are improperly formatted, contact the appropriate FAA facility through which the transmitted report was improperly formatted to take corrective action.

3. Notice to Airmen (NOTAM) Reporting. The aviation observation program must be maintained to support aircraft operations. In order that the appropriate NOTAM be issued in accordance with FAA regulatory requirements, the FAA must be notified in the event of an ASOS failure when:

a. the entire ASOS observation is missing and no backup observation is available for long-line dissemination;

b. the altimeter setting is missing and is not backed up;

c. the date/time group is erroneous and has not been corrected.

The WFO responsible for QC of the ASOS site is also responsible for notifying the FAA of the need for NOTAM issuances and cancellations. The WFO will follow the following procedure:

a. When one of the three events occurs at a site within the WFO CWA, notify the appropriate FAA facility that the failure/error has occurred.

b. Monitor the event and notify the FAA facility when the conditions have been corrected and the date/information are available/corrected.